DOCUMENT RESUME

ED 281 710 SE 047 827

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TITLE The Population Challenge. A Teaching Unit from ZPG.
INSTITUTION Zero Population Growth, Inc., Washington, D.C.
PUB DATE 85
NOTE 9p.; Colored photographs may not reproduce well.
AVAILABLE FROM Zero Population Growth, Inc., 1601 Connecticut Ave., NW, Washington, DC 20009 ($1.00 per reprint; classroom set of 30 reprints, $5.00).
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Controversial Issues (Course Content); Ecology; *Elementary School Science; Elementary Secondary Education; *Environmental Education; Global Approach; *Population Education; Population Growth; Population Trends; Science Activities; Science and Society; Science Education; *Science Instruction; *Secondary School Science; Social Studies
IDENTIFIERS *Zero Population Growth

ABSTRACT

Maintaining a balance between population and the resources needed to sustain life on earth is a critical challenge. This teaching unit focuses on this challenge by providing teachers with information and activities on both the national and global impacts of population growth. The document contains: (1) basic information about the population challenge; (2) some techniques for helping students understand large numbers; (3) a riddle on exponential growth; (4) a quiz on population and the environment (along with an answer key) which can be used in connection with an insert; (5) a list of statements for student reactions; (6) classroom and out-of-school activities; and (7) a listing of fact sheets, films, brochures, newsletters, and teaching kits that deal with population. A special insert, "The Population Challenge," provides additional background information on this issue. The insert contains a call for a need for greater awareness, explanations about the earth's life support systems, and options for individual action. (TW)

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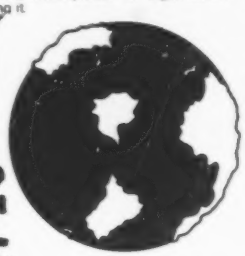

THE POPULATION CHALLENGE

A Teaching Unit from ZPG

WHAT IS THE POPULATION CHALLENGE?

Humans face a critical challenge: maintaining a balance between population and the resources needed to sustain life on our fragile planet.

In only 70 years-- less than the average American's lifetime-- the world's population will increase threefold, from 2 billion in 1930 to more than 6 billion in the year 2000.

Until very recently, it was inconceivable that there would ever be more people than the earth could support. Today, however, it is widely accepted in the scientific community that we must plan ahead for that possibility.

"The Population Challenge," written for secondary students, describes the effects of population growth on the natural support systems necessary for human survival and discusses individual actions that can help maintain a balance between people, resources and the environment.

Although "The Population Challenge" stands on its own as student reading material, teachers are also encouraged to build class activities around it to further students' understanding. A number of such activities are suggested in this teaching guide, and a list of population education resources for teachers is included as well.

HELPING STUDENTS UNDERSTAND LARGE NUMBERS

Here are some riddles to help students grasp the meaning of large numbers in the millions and billions.

1. Your rich uncle has just died and left you $1 billion. If you accept the money you must count it for 8 hours a day at the rate of $1 per second. When you are finished counting, the $1 billion is yours and then you may start to spend it. Do you accept your uncle's offer? How long will it take you to count the money?

2. If you spent $1 million at the rate of $1000 per day, how long would it take you to spend it?

3. How long would it take to spend $1 billion at the same rate?

Answers: 1. It would take 95.13 years.
2. 1000 days, or about 2-3/4 years.
3. 1,000,000 days, or about 2,740 years.

A RIDDLE ON EXPONENTIAL GROWTH

In considering the J-curve graph on page 1, use this riddle to show how a constant rate of growth applied to an increasing base accelerates growth:

A father complained that his son's allowance of $5 per week was too much. The son replied, "Okay, Dad. How about this? You give me a penny for the first day of the month, 2 cents for the next, 4 cents for the next, and so on for each day of the month." The father readily agreed. Who was more clever? How much would the son receive on the 31st day of the month?

Answer: $10,737,418.24

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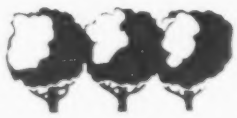
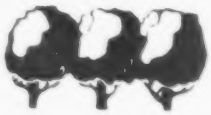


QUIZ ON POPULATION AND THE ENVIRONMENT



This multiple-choice quiz can be used to stimulate interest in reading "The Population Challenge" or to test understanding of the material once it has been read. As an "open book" test, it may encourage students to find the answers.

1. Approximately what will be the population of the world in the year 2000?
(a) 900 million (b) 2 billion (c) 4 billion (d) 6 billion
(e) 10 billion

2. Approximately what will be the population of the United States in the year 2000?
(a) 170 million (b) 200 million (c) 240 million (d) 270 million
(e) 300 million

3. How much of the world's population growth by the year 2000 is expected to occur in Asia, Africa and Latin America?
(a) 30% (b) 45% (c) 60% (d) 75% (e) 90%

4. Which of the following is <u>not</u> one of humans' fundamental life-support systems?
(a) fisheries (b) grasslands (c) forests (d) croplands
(e) cities

5. Which of the following natural systems is currently being rapidly destroyed, which may lead to a change in the whole world's climate conditions?
(a) rain forests (b) fresh-water lakes (c) deserts (d) marshes
(e) glaciers

6. Which country instituted a "one-child-per-family" policy after losing some 30 million people in a famine?
(a) Japan (b) China (c) Ethiopia (d) Ghana (e) India

7. Which of the following is <u>not</u> a current example of the strains caused by population growth in the United States?
(a) water shortages (b) smog (c) school closings (d) traffic jams
(e) overflowing dumpsites

8. What can Americans do to help make sure future generations all over the world have the natural resources they need?
(a) have smaller families (b) recycle (c) use fuel-efficient cars or public transportation (d) all of the above (e) none of the above

(Answers: 1-d, 1-d, 3-e, 4-e, 5-a, 6-b, 7-c, 8-d)

TAKE A STAND!

Sometimes it is easier to think through a difficult issue if one is asked to "take a stand" on it. This activity was designed with that in mind.

Designate one side of the room as "strongly agree" and the other side as "strongly disagree." Read the following statements and ask students to stand in the part of the room that reflects their opinion. Students can also stand closer to the middle if they merely "agree" or "disagree" but not strongly. Ask students to explain why they've taken a particular stand.

If this activity seems too cumbersome, students may respond from their seats by indicating "thumbs up" or "thumbs down" in agreement or disagreement with the statements.

Statements

1. In a real crunch, jobs are more important than environmental quality.

2. Our current environmental protection laws are adequate; more stringent laws will cost too much.

3. Arable land should not be used for shopping centers, housing developments and other urban uses.

4. Food aid should be given only to those countries which have policies designed to limit their population growth.

5. The U.S. should adopt a population policy with goals for overall population size and annual limits on legal immigration.

6. Much more land should be set aside for wilderness areas with limited public access.

7. At some point in the future we will run out of an essential resource.

8. The next century is likely to be a better time to live than the present.

(Adapted from The Environment to Come: A Global Summary, Population Reference Bureau, Washington, D.C.)

OTHER ACTIVITIES FOR THE CLASSROOM AND BEYOND

- Ask students to identify their own experiences with crowding and pollution in America. As they give specific examples, ask: What do you think caused this smog, traffic jam, water pollution, etc.? What might have prevented or remedied it?

- Discuss the impacts of 1-, 2- and 3-child families on resource consumption, using the diagram on page 3 of "The Population Challenge." Have students construct a similar diagram for a 4-child family (64 members by the 3rd generation and 256 by the 4th).

- Invite students to record the ways they use energy in a typical day and try to substitute less energy-intensive activities. Suggest a one-week "energy diet" to see how little energy they can use.

- Start a recycling project. Have students collect newspapers or aluminum cans from neighbors and classmates and deliver them to a local recycling center.

- Suggest that students conduct a water audit of their school or homes, recording all the ways water is used. Then challenge them to design a conservation plan to reduce use.

"POPULATION CHALLENGE" TEACHING RESOURCES

Films

World Population. 1972, 3 minutes, 16mm. A graphic portrayal of world population growth and distribution from 1 A.D. to the year 2000.

Mexico in the Year 2000. 1979, 12 minutes, 16mm. Describes the rapid increase in Mexico's population since 1900 and the problems anticipated in providing housing, food, jobs and education for 132 million Mexicans in the year 2000.

Population Time Bomb. 1977, 28 minutes, 16mm. From Jacques Cousteau's "Oasis in Space" series, this film shows Carl Sagan, Paul Ehrlich, Margaret Mead, Buckminster Fuller and others discussing population stresses in developing and developed nations.

Each of these films may be rented for $10.00 from the Population Reference Bureau, 777 14th St. NW, Washington, DC 20005.

ZPG Fact Sheets and Brochures

- China's One-Child Family: A Famine-Forced Decision
- Improving the Status of Women Key to Population Control
- New Calls for a "Child-Survival Revolution"
- New Programs Tackle Teen Pregnancy
- Creating the Coming Century
- Population Growth and U.S. Agricultural Land: A Crisis in the Making?
- Population Growth: The Local Perspective

ZPG Teaching Kits and Newsletter

EdVentures in Population Education. This teaching kit offers 16 activities to introduce upper elementary through secondary students to population concepts. Also includes data charts, masters, poster, teacher's guide, glossary and bibliography. Use the activities separately, to complement almost any subject, or together, as a comprehensive population studies unit. $20.00.

Global 2000 Countdown Kit. A comprehensive teaching kit on the earth's population, environment and resources. Fourteen attractively designed modules cover such topics as population, income, food, energy and more. Develops skills in a variety of subject areas, including math, social studies, science and environmental studies. $20.00.

The Teachers' PET Term Paper. A quarterly newsletter with news of population education training opportunities, classroom activities, new films, books and curricula, and a readers' exchange forum. $3.00/year.

All ZPG resources are available from Zero Population Growth, 1601 Connecticut Avenue NW, Washington, DC 20009.

"The Population Challenge" Teaching Unit was written by Deborah E. Brouse. Additional copies are available from ZPG (address above). Teacher's guide with a single copy of "The Population Challenge" reprint costs $1.00; with a classroom set of 30 reprints, $5.00.

It took about three million years for the global community to reach one billion. It took just 175 more years to reach four billion.

It is a warm late-spring morning in America. Students in a high school auditorium in Maine join in the traditional song for opening an assembly: "O beautiful for spacious skies, For amber waves of grain . . ."

As they sing, a few seniors gaze out the window at the pines sloping downhill from their school. There is not another building in sight. It is hard for these students to imagine that America has a population problem.

Asia, Africa, Latin America: These are the places Americans usually associate with population crises. By what twist of the imagination is the United States on such a list? It boasts the highest standard of living in the world. Its farms produce more food than Americans need or even can sell. Western states like Wyoming and Nebraska have unsettled grasslands that stretch as far as the eye can see.

But appearances are deceiving. Many sparsely populated areas in America cannot support large numbers of people. The country's high-tech farms require only two percent of the population to run them. And so Americans congregate in cities and expanding suburbs.

The impact of 5 or 10 million densely packed Americans on an urban region is incredible. Overcrowding in Los Angeles, for example, slows freeway traffic to 20 m.p.h. for 14 hours of every day. Cars, factories, and power plants pour tons of toxic pollutants into the air. Winds carry acid rain formed by these nitric and sulphuric wastes to neighboring states. The smog in Los Angeles and other big cities is an all-too familiar example of environental harm resulting from overpopulation.

NEED FOR AWARENESS — THE ROLE OF ZPG

Measured by the length of human history, the population problem is recent. It took about three million years for the global community to reach one billion, the total in 1800. In just 130 years more, the number doubled. By 1960, it was three billion; by 1975, four billion. It is projected that six billion humans will inhabit the Earth in the year 2000.

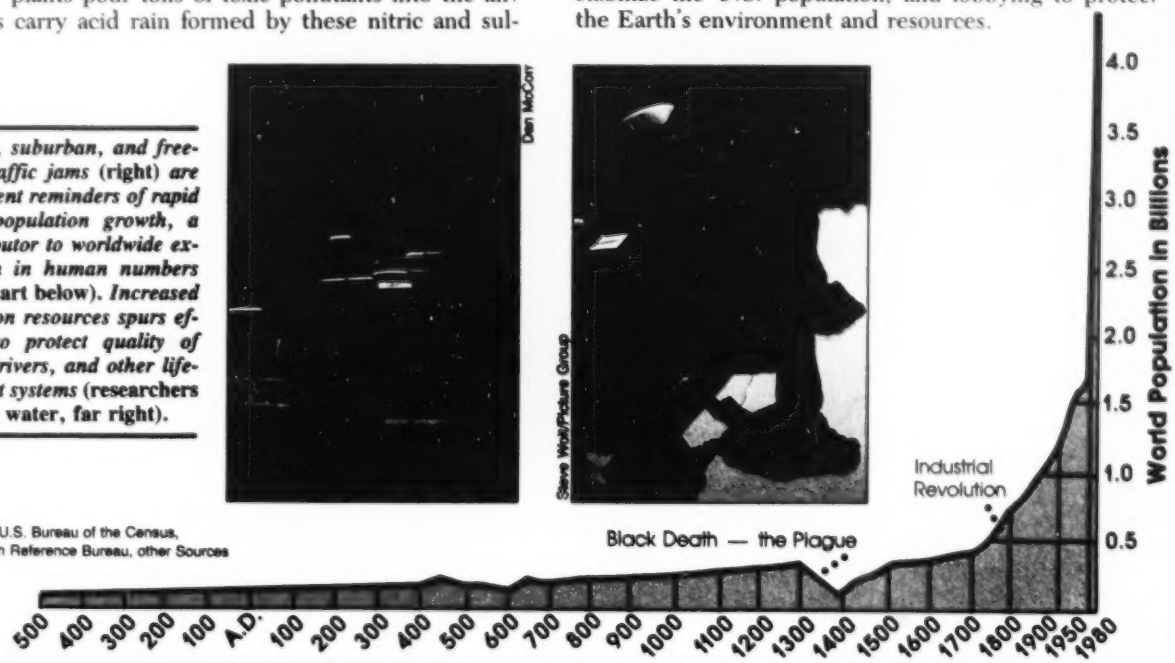
The most visible effects of this explosion have been in the poorest countries of the world. But by the 1960s, the special, two-fold impact of the U.S. population crisis was also clear. Not only are Americans — rapidly growing by two million every year — damaging their own environment. As the world's super-consumers, they drain precious resources from every other continent as well.

The situation is so serious that some Americans work full-time at resolving it. In 1968, appalled by what they saw as the coming population explosion, Dr. Paul Ehrlich and other concerned citizens formed Zero Population Growth (ZPG), a national, nonprofit organization that works on two fronts: urging voluntary efforts to stabilize the U.S. population, and lobbying to protect the Earth's environment and resources.

Dan McCoy

Steve Wall/Picture Group

***Urban, suburban, and freeway traffic jams* (right) *are persistent reminders of rapid U.S. population growth, a contributor to worldwide explosion in human numbers* (see chart below). *Increased drain on resources spurs efforts to protect quality of lakes, rivers, and other life-support systems* (researchers testing water, far right).**



Sources: U.S. Bureau of the Census, Population Reference Bureau, other Sources

American demands on resources directly affect global life support systems.

Paul Solomon/Wheeler Pictures

Grant Heilman Photogr

John Dominis/Wheeler Pictures

***Suburban construction* (far left) *buries a million acres of prime U.S. land annually. Even remote Four Corners in U.S. Southwest is source of eastward-drifting industrial smog* (above). *Tropical forests are gouged at [illegible] rate of 27 million acres* (left).**

"The human family is doing something that no sane family would ever do. It is living off its capital while it is destroying . . . [that capital's] earning power."
— Paul Ehrlich

Dust scudding before a windstorm, tiny brown algae growing at a lake's edge, dying branches at the top of a tall tree, invisible particles of sulphur in the air: It's easy to ignore such things while traveling through a local park or on a suburban road. On a global scale, however, they are symptoms of the threat to Earth's environment and, therefore, to our global economy.

Americans tend to think of a healthy economy in terms of a favorable balance of trade or high employment. But the basic building blocks of a nation's or region's economic health are four major biological systems: Earth's ocean fisheries, grasslands, forests, and croplands. *These are fundamental life-support systems.* In an overpopulated planet, the health of these systems is increasingly at risk.

EARTH'S LIFE-SUPPORT SYSTEMS

* **Fisheries.** The oceans have always been the principal source of high-quality protein for humans. And the fish that humans don't eat, birds and other animals do. *Since 1970, the annual catch per person has dropped 13%.*
* **Grasslands.** One fifth of the planet's land is grazed by billions of animals that, in turn, sustain billions of people through the meat, milk, cheese, leather, and fur they supply. *As swelling populations expand their livestock herds, huge grasslands are being grazed to dust.*
* **Forests.** Wood is a primary building material all over the world and is the principal energy fuel in many developing countries. *Since 1974, the world's forests have been cut faster than they can replace themselves.*
* **Croplands.** Topsoils are the source of the greatest variety of products, including foods and industrial raw materials: rubber, fibers, alcohols, and vegetable oils. *Both subsistence farming and the cash crops of big business have destroyed millions of acres of croplands.*

In many places Earth's life-support systems are breaking down with terrible human consequences. The tragic news of expanding deserts and deepening famine in Africa is familiar to every American. China, with a one-billion-plus population, instituted its strict "one-child family" policy after losing as many as 30 million people in a 1960s famine. An estimated 15,000 landless farmers in Bangladesh recently lost their lives in a tidal wave after taking the desperate risk of settling on a low, silt-formed island in a cyclone belt.

How do such problems touch America? Is there anything beyond the impact of daily news reports that connects us to the environmental crises of other nations?

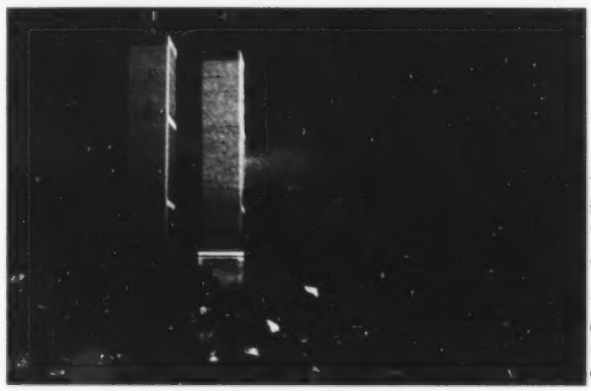
GLOBAL TIES

American wants cannot be met only by resources found in the United States. Though we make up five percent of the world's population, we use ten times the world average in energy consumption, six times the steel, and four times the grain. Our demands on the planet's resources have a direct effect on the life support systems in other regions. Tropical rain forests, which have a potential impact on climate conditions all over the globe, are now being cut at the rate of 50 acres per minute. In some cases the land is then converted to cattle-grazing — not for local use — but to supply American fast-food restaurants with hamburgers. Similar demands involve us intimately with all parts of the globe.

Because we are deeply dependent on other regions of the world, it is in our own interest to help sustain the people and preserve the resources of these regions. Otherwise, our short-term human wants will endanger our long-term human survival.

Individuals can make choices that reduce stress on resources and environment.

John deVisser/Black Star



Danilo Boschung/Leo de Wys Inc.

***Swelling numbers in India endure crowded shelters* (top); *densely packed U.S. populations produce sprawling dump sites* (above). *Decisions about family size affect rate of population growth all over the world* (chart below).**

"Our security and future well-being may be threatened less by the conflicts among nations than . . . by the deteriorating relationship between ourselves, . . . and the natural systems and resources that sustain us."

— *Lester R. Brown*, State of the World, 1984

Without a change in present trends, the world's population will top 6 billion by the year 2000 — increasing by 100 million a year. (That's equivalent to adding a population the size of America's every two to three years.) Ninety percent of this growth will occur in Asia, Africa, and Latin America, where most people will be young, and where most of the young who survive infant malnutrition will be streaming toward cities looking desperately for work. Americans will experience added crowding by 2000, when their numbers are expected to reach 270,000,000 — up 12% from 1985.

What will tomorrow be like in such a crowded world? The strains of population growth are already visible in developing nations. They are also noticeable in America — in the water-short sprawl of Phoenix and Los Angeles, in the annual conversion of one million acres of prime farming land to residential and commercial use, in overflowing dumpsites and tainted water supplies. In such things, "tomorrow" is already here.

FACING THE PROBLEM

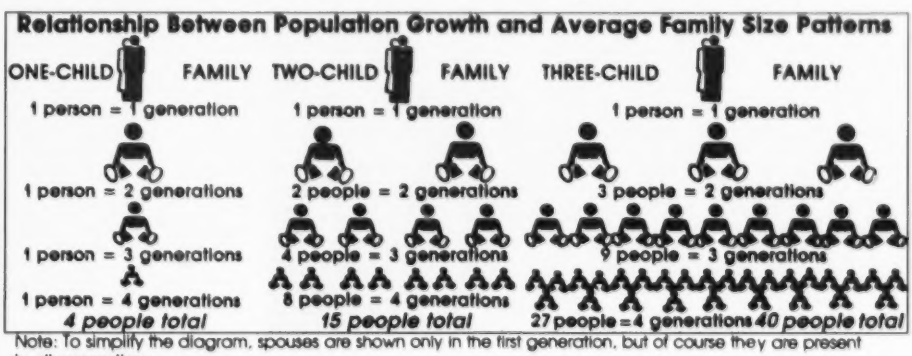
What can be done? There are better alternatives than competing with one another for the last best space or the only remaining clean water. Certainly, we can encourage our government to help us and other nations deal with population and environmental problems. But there are also things we can do as individuals, choices we can make in our lifestyle and in how we raise our families, that will significantly reduce the stress on our resources and environment.

* **Lifestyle.** We can protect our life-support systems by making thoughtful choices about where we live, how we use energy in our homes, what we eat, how we travel, and whether and how we use "throw-aways." By making such choices, we can have a collective, healing impact on the biological systems that sustains us.
* **Family size.** Many American parents already limit their families to one or two children (a number that would lead to population stabilization.) Young couples recognize the benefits of waiting until they're older to have children and of then spacing their births by several years — two factors that slow the growth rate.

Do such choices really make a difference? Compare two families: After four generations, a family with a three-child tradition will consume 160 percent more resources (including fish, meat, wood, and vegetable products) than a two-child-per-generation family.

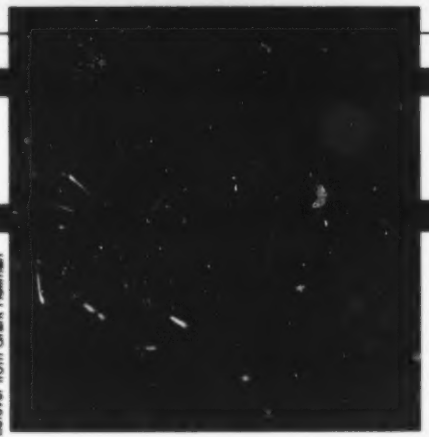
A child's best chance for a happy life flows from a combination of things: parental love; adequate food, water, and space; and the security that comes from finding, as he or she grows older, that the *next* generation will have these resources. Two commitments can protect such a legacy for the world's children: responsible parenting and caring for the environment.

Richard Hutchins


Relationship Between Population Growth and Average Family Size Patterns
ONE-CHILD FAMILY
1 person = 1 generation
1 person = 2 generations
1 person = 3 generations
1 person = 4 generations
4 people total
TWO-CHILD FAMILY
1 person = 1 generation
2 people = 2 generations
4 people = 3 generations
8 people = 4 generations
15 people total
THREE-CHILD FAMILY
1 person = 1 generation
3 people = 2 generations
9 people = 3 generations
27 people = 4 generations
40 people total

Graphic Chart & Map Co.

Note: To simplify the diagram, spouses are shown only in the first generation, but of course they are present in all generations.



Leitzer from Grant Heilman

As the 21st century approaches, the whole world is becoming our community.

No-till farming* (left) *and recycling help conserve resources* (right). *Small families* (below) *are fast becoming U.S. model. Children of tomorrow's world depend on our ability to protect the environment, limit population growth today.

Peter Arnold, Inc.

The Earth cannot support a larger population of any species than it can supply food for. Homo sapiens is the one species that might succeed through thought and foresight in making use of the . . . constraint of a lowered birth rate.

— Isaac Asimov, in a tribute to ZPG

Can people really be persuaded to change the way they live if it restricts some of their individual choices? Where the problem and the remedies are clear, many are already doing so. In the protection of croplands, for example, there's a revolution afoot. Take the case of the farmers in Kent County, Maryland.

Until recently, about six tons of topsoil per acre were annually washing off Maryland cropland, much of it ending up in the Chesapeake Bay and its feeders. With this soil came phosphorus and nitrogen — productive elements in the soil, but deadly killers in the water. In Maryland, this meant a huge loss in the catch of crabs and oysters.

To stop this deadly cycle, about half of the Kent County farmers altered their traditional farming methods. Now, instead of using a steel plow to open their fields for wheat planting (and thereby loosening the soil to be washed away), these farmers use "no-till" farming. They insert the wheat seeds into the soil through a slim metal disk that leaves the soil unplowed and still protected by the remains of the previous crop. No-till farming reduced soil erosion in Maryland by 600,000 tons in 1984 alone: the result of one change in one method of work.

Americans are opting for resource conservation in many other walks of life:

* Recycling — from bottles, to paper, to non-potable water — has become an industry itself. "Bottle bills" requiring returnable deposits have been passed in a handful of states. More than 90 percent of all such containers are returned for recycling in these states.
* Family cars today are bought with fuel economy, as much as space for the passengers, in mind. Millions of suburban commuters travel to work in car pools, trains or buses.
* For other reasons as well, but also out of a desire to conserve nonrenewable fuels, American businesses and families have reduced their consumption of petroleum by almost 20 percent in less than 10 years.

Peter Arnold, Inc.

SMALLER FAMILIES

The trend toward smaller families in the United States is just as easy to document. When ZPG was founded in the late 1960s, the U.S. fertility rate (average number of children per woman) was 2.5. Today, the two-child family has become an accepted American image. Women, waiting to complete their education and gain work experience, are delaying the birth of their first child and then tend to wait a few years more for their second.

Parents in the 1980s are realizing the truth in anthropologist Margaret Mead's observation that "issuing fewer invitations to the next generation will make certain that all of those invited will have a better time."

Do individual efforts to conserve resources and limit family size really have an impact? Yes, when the decisions of many individuals are taken together. When members of a community choose ways of living that respect each other's needs, the entire community experiences a higher quality of life. As the 21st century approaches, the whole world has become our community.

There is one element of this community that has a special claim on us: Tomorrow's children, in every corner of the Earth, depend on our willingness today to protect the planet's resources and to limit the numbers we invite to share its beautiful, fragile life-support systems.

For further information, contact:

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